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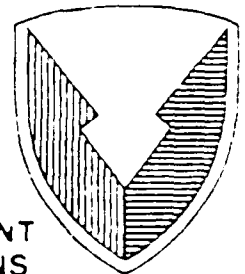
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SLINGING DAMAGE DETERMINATION
OF PA104 CONTAINERS UNITIZED AS
19-48-4079/6A

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102

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FIELD	GROUP	SUB-GROUP			
19. ABSTRACT (Continue on reverse if necessary and identify by block number) The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division (SMCAC-DEV), has been asked by the U.S. Army Armament, Munitions and Chemical Command to determine slinging damage to the PA104 container as a result of slinging with a basket sling. This study was initiated by a message indicating excessive damage to the PA104 container in ship off loading. The Unitization procedure for this unit was 19-48-4079/6A. The unit was raised with a basket sling and allowed to free fall drop from different heights without hitting the ground. The stopping force was measured with a load cell. The drop height varied between 18 inches and 36 inches. The sling angle at the top of the pallet varied from 45 degrees to 20 degrees. It was found that a drop of 18 inches with a sling angle of 45 degrees would dent the PA104 containers on the top outside corners. Damage became progressively worse as the drop height increased and the sling angle decreased.					
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT <input type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION		
22a. NAME OF RESPONSIBLE INDIVIDUAL			22b. TELEPHONE (Include Area Code)		22c. OFFICE SYMBOL

No. 19 Abstract

The containers damaged as a result of lifting with a basket sling did not duplicate the damage that occurred during port handling operations.

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL

Evaluation Division

Savanna, IL 61074-9639

REPORT NO. 6-89

SLINGING DAMAGE DETERMINATION OF PA104

CONTAINERS UNITIZED AS 19-48-4079/6A

TABLE OF CONTENTS

PART	PAGE NO.
1. INTRODUCTION	1-1
A. BACKGROUND	1-1
B. AUTHORITY	1-1
C. OBJECTIVE	1-1
D. CONCLUSIONS	1-1
E. RECOMMENDATIONS	1-1
2. ATTENDEES	2-1
3. TEST PROCEDURES	3-1
4. TEST RESULTS	4-1
5. FIELD DATA	5-1
6. UNITIZATION PROCEDURE	6-1

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Unannounced	<input type="checkbox"/>
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By	
Distribution	
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PART 1

INTRODUCTION

A. BACKGROUND

The U.S. Army Defense Ammunition Center and School (USADACS), Evaluation Division (SMCAC-DEV), was asked by the Storage and Outloading Division (SMCAC-DED) to evaluate the unitization procedure 19-48-4079-6A in terms of damage that can be expected while this unit is handled with slings. The basis for this request was the result of dented containers from ship or barge offloading operations being accomplished with slings.

B. AUTHORITY

This test was conducted in accordance with mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL 61299. Reference is made to Change 4, 4 October 1974, to AR-740-1, 23 April 1971, Storage and Supply Operations; AMCCOM-R 10-17, 13 January 1986, Mission and Major Functions of USADACS.

C. OBJECTIVE

The objective of this test is to reproduce damage caused to PA104 containers during port offloading operations in the 4079/6A unitization configuration.

D. CONCLUSIONS

The damage produced by rapid descent tests did not mirror the damage caused by port loading or off loading operations. Lifting with chain basket slings will cause minor denting of the top two outside containers. Any sudden stops while lowering a unit with basket type slings will deform the top PA104 containers to a point that the material contents cannot be removed.

Photos showing the damaged containers from the port indicate that the damage was caused by abnormal slinging operations. Case in point: The torn PA104 container was located in the second row of containers; damaged containers

with a chain basket sling were on top of the pallet.

E. RECOMMENDATIONS

To prevent slinging damage, additional dunnage must be added to the unitization procedure to prevent contact of the basket sling with the containers.

PART 2

ATTENDEES

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PART 3

TEST PROCEDURES

The test procedures for this test consists of two parts: the first part is the test procedure for undersling handling extracted from FED-STD-101, Method 5011, Paragraph 6.3.1; the second part was developed to typify a rapidly falling underslung load that was abruptly stopped.

A. UNDERSLING HANDLING

Two slings without spreaders shall be placed around the specimen, each passing beneath the specimen, one near each end where indicated on the package/pallet and brought to a common point above the center of balance for attachment to the hoist. When no indication is provided, locate slings at outside end of rubbing strips if possible. If not possible, locate slings midway between the center of balance and the ends. Lift the specimen and any superimposed load, and hold suspended for not less than two minutes. Observe carefully for any indications of inadequacies and let the specimen down.

B. RAPID DECENT AND UNDERSLING HANDLING

Two slings without spreaders shall be placed around the specimen, each passing beneath the specimen, one near each end where indicated on the package/pallet and brought to a common point above the center of balance for attachment to the hoist. When no indication is provided, locate slings at outside end of rubbing strips if possible. If not possible, locate slings midway between the center of balance and the ends. Lift the specimen and any superimposed load, and hold suspended for not less than two minutes. After the two minute period release the specimen and allow it to free fall a predetermined distance. The predetermined distance shall be such that the specimen shall not hit the floor and stopping the descent is accomplished solely by the slings. Observe carefully for any indications of inadequacies and let the specimen down.

PART 4

TEST RESULTS

TEST NO. 1

DATE: 22 FEB 1989

TEST SPECIMEN: PA104 UNITIZED ON A 4-WAY ENTRY PALLET.

DROP	VERTICAL FORCE (pounds)	SLING ANGLE (degrees)	DROP HEIGHT (inches)	REMARKS
0	2200	45	0	Static weight pickup. Slight denting of the two upper outside PA104 containers.
1	5400	45	18	Well defined deformation of the two upper outside containers.
2	5400	30	18	Unitization starting to bow on the pallet. Increased deformation.
3	6700	20	28	Containers starting to bow from flattening of the cylindrical wall.
4	7600	20	36	Top outside containers have reduced outer diameter to about one third the original diameter.

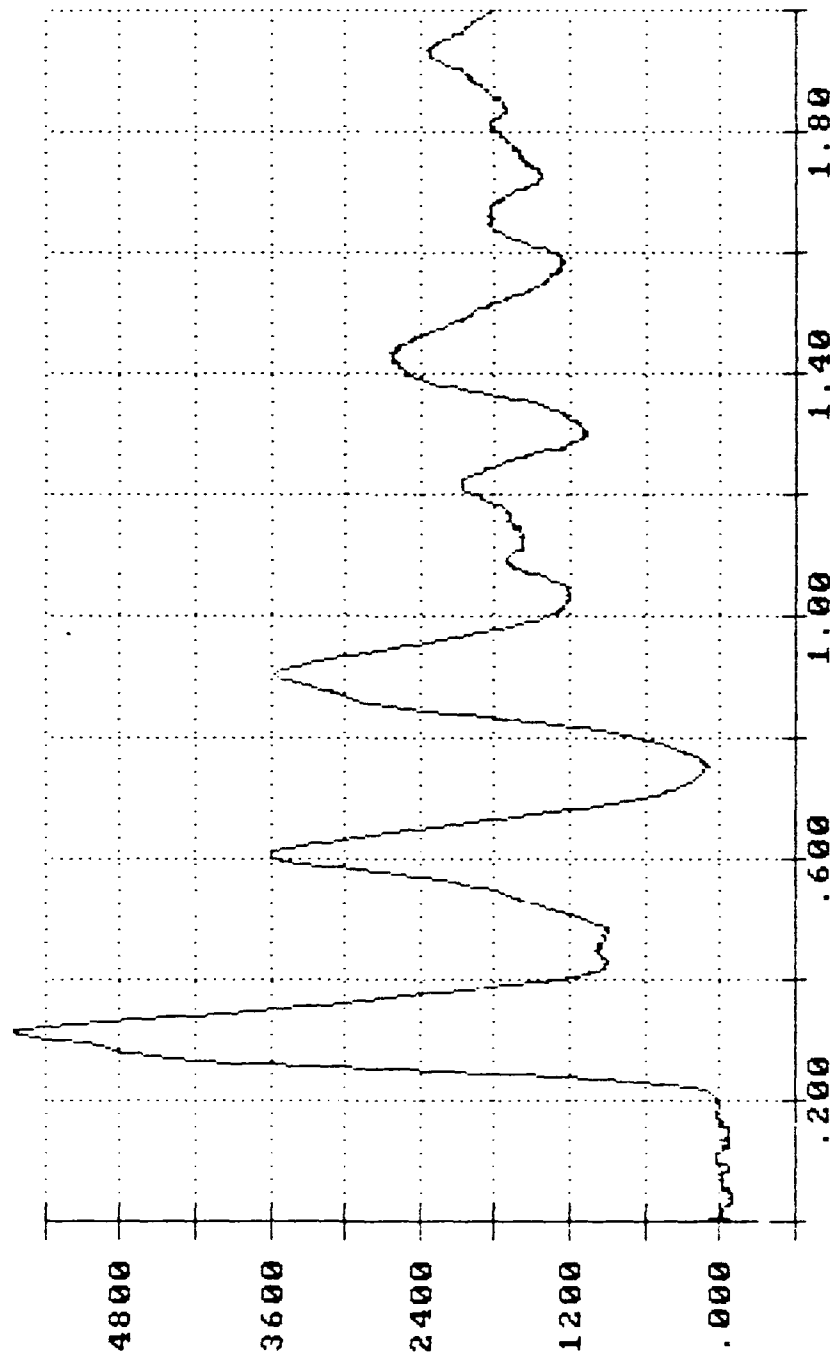
Notes:

- a. Container damage was confined to the upper outside PA104 containers where the chain basket circled the pallet and came together at point of pickup.
- b. Drop forces are recorded, peak forces recorded.

PART 4

TEST DATA

DROP TEST ON PA104 CONTAINERS ON WOOD PALLET
DROP 1, 45 DEGREE SLING ANGLE, 18 INCH DROP HEIGHT

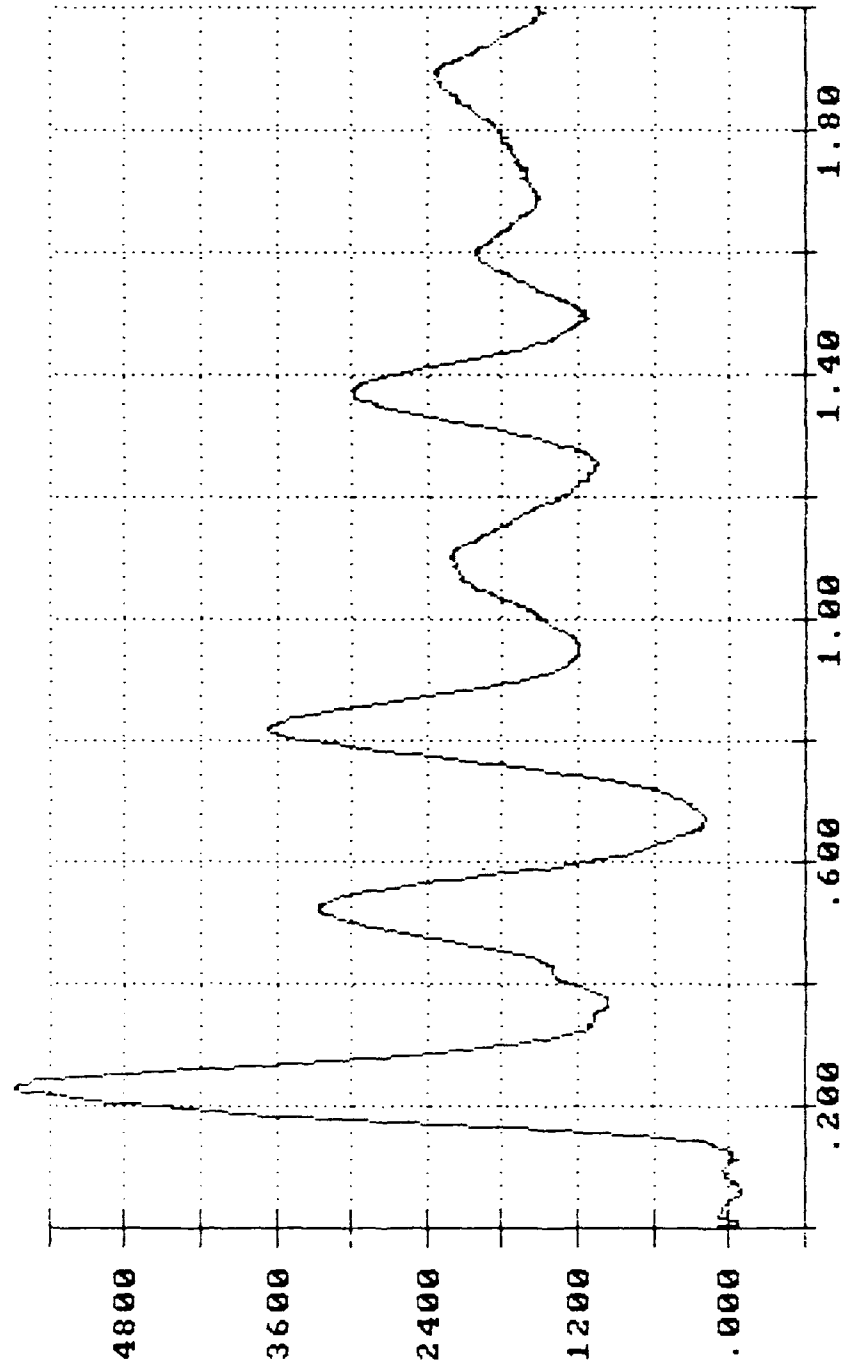


Time in Seconds
X 1.00

IN POUNDS X 1.00

LOAD CELL FORCE

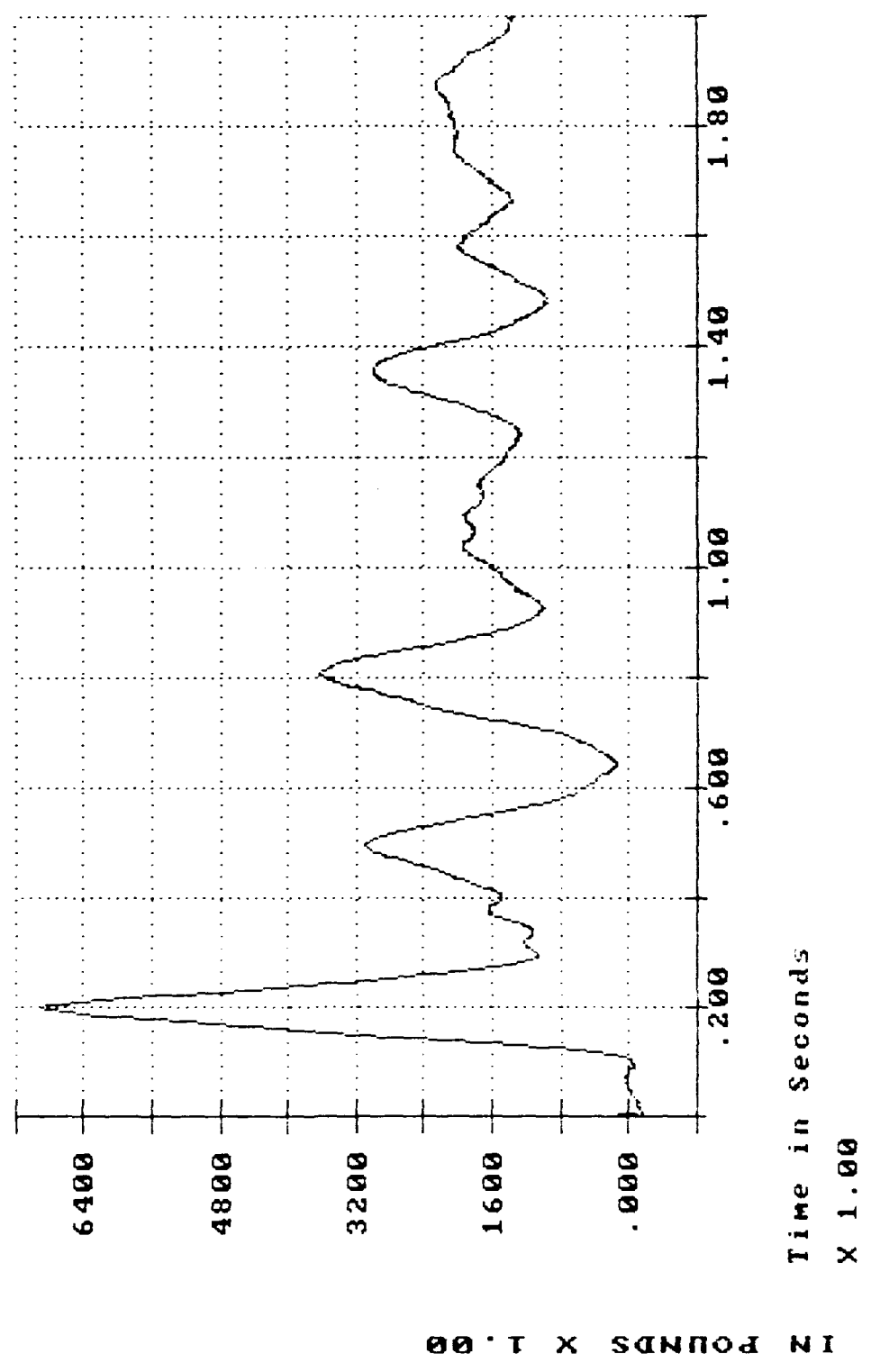
DROP TEST ON PA104 CONTAINERS ON WOOD PALLET
DROP 2, 30 DEGREE SLING ANGLE, 18 INCH DROP HEIGHT



LOAD CELL FORCE
IN POUNDS X 1.00

Time in Seconds
X 1.00

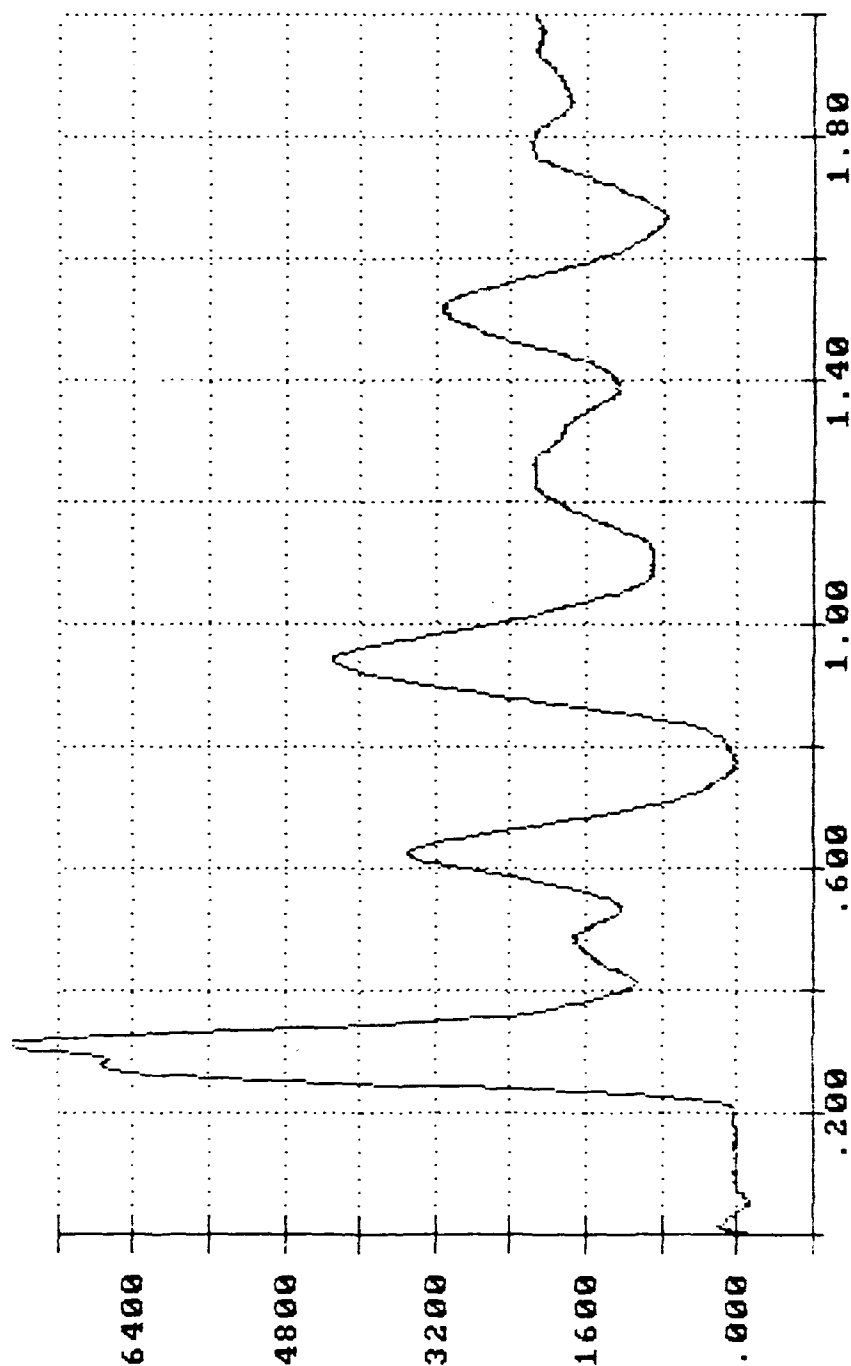
DROP TEST ON PA104 CONTAINERS ON WOOD PALLET
DROP 3, 20 DEGREE SLING ANGLE, 28 INCH DROP HEIGHT



LOAD CELL FORCE
IN POUNDS X 1.00

Time in Seconds
X 1.00

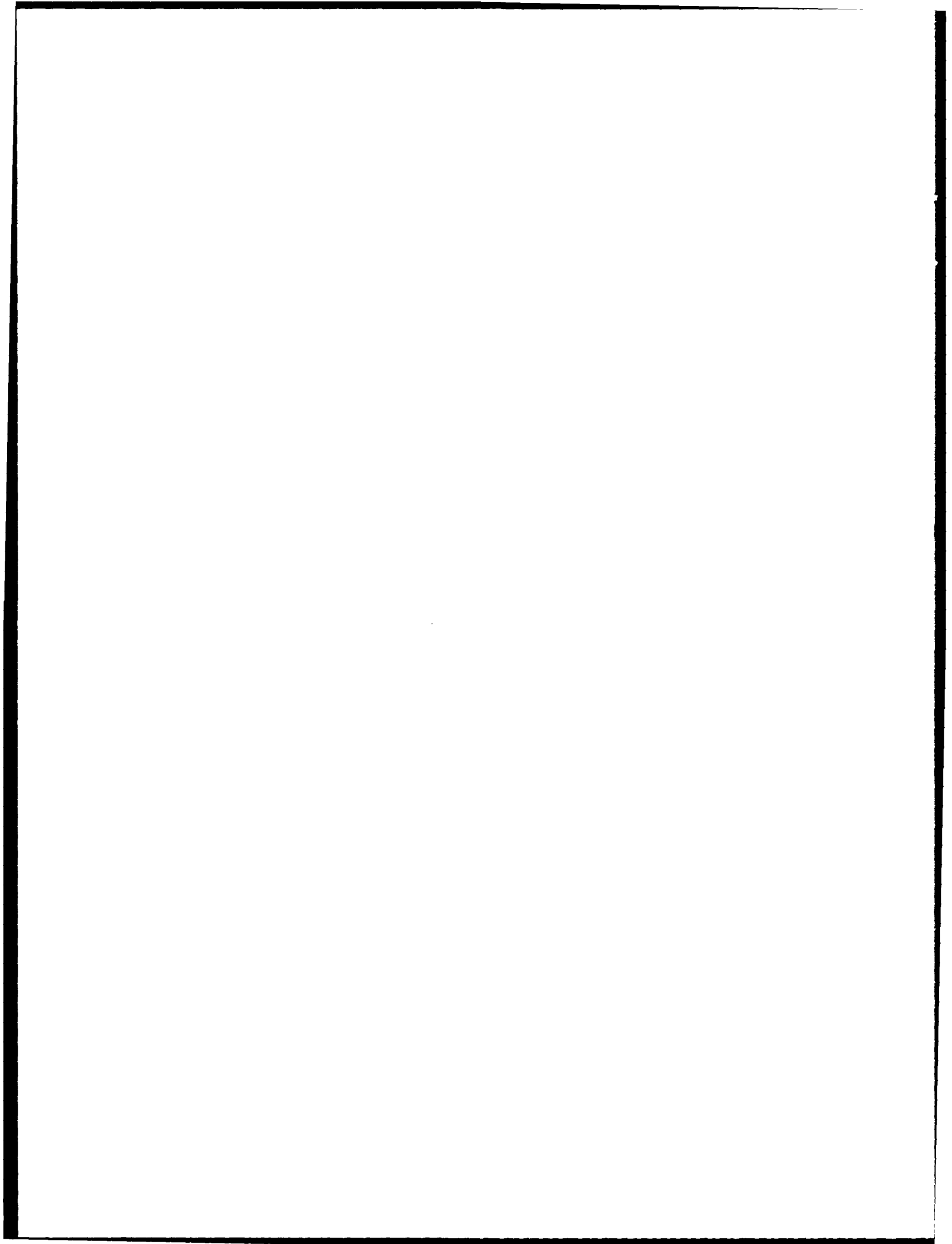
DROP TEST ON PA104 CONTAINER ON WOOD PALLET
 DROP 4, 20 DEGREE SLING ANGLE, 36 INCH DROP HEIGHT



Time in Seconds
 X 1.00

IN POUNDS X 1.00

LOAD CELL FORCE



PART 4
PHOTOGRAPHS



DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL

PHOTO NO. 1 This photo shows the PA104 Unit after the first drop. Note the chain slings deforming the container sidewall. To the right on the top container is a slight indentation from normal slinging of the pallet.

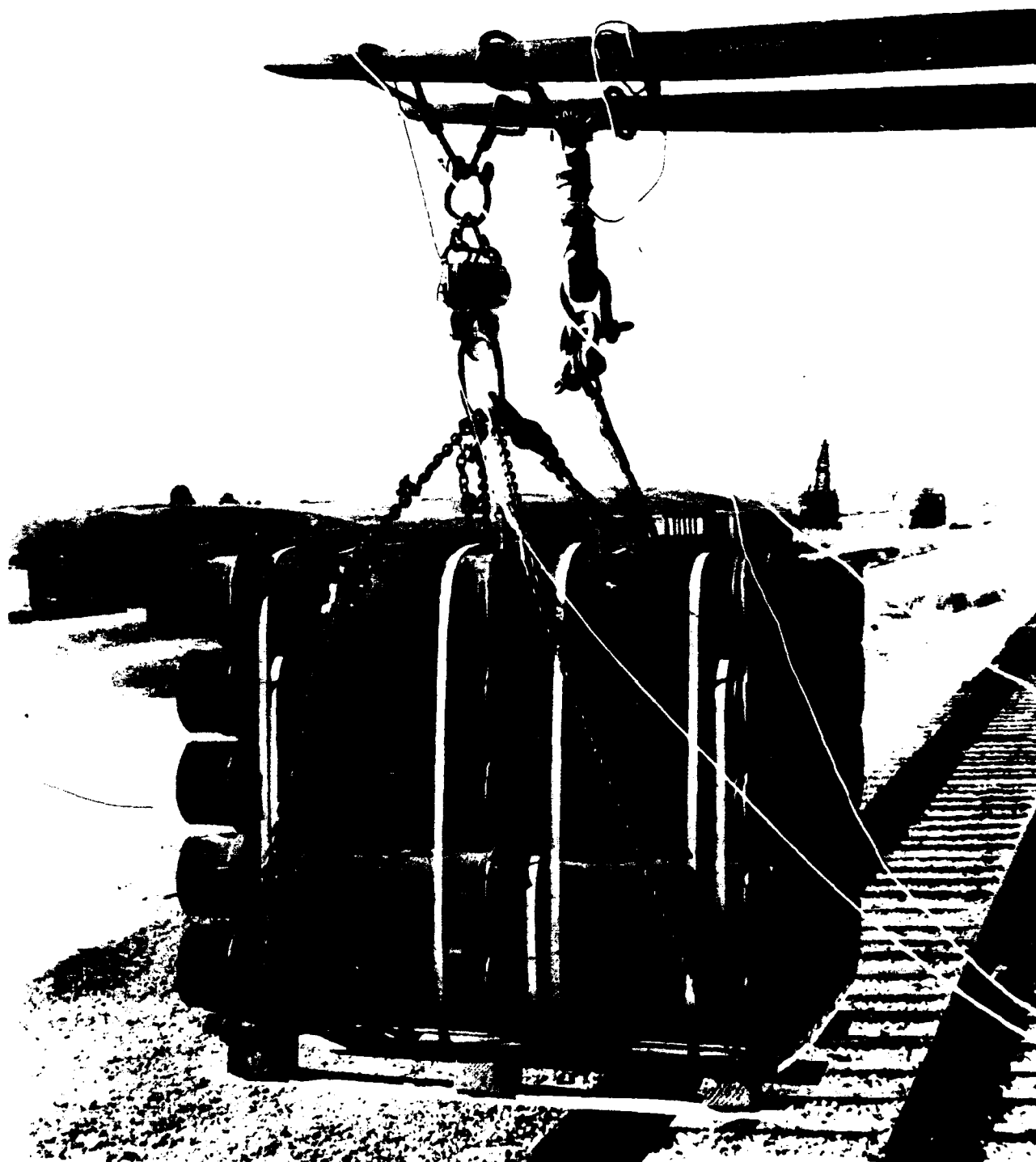


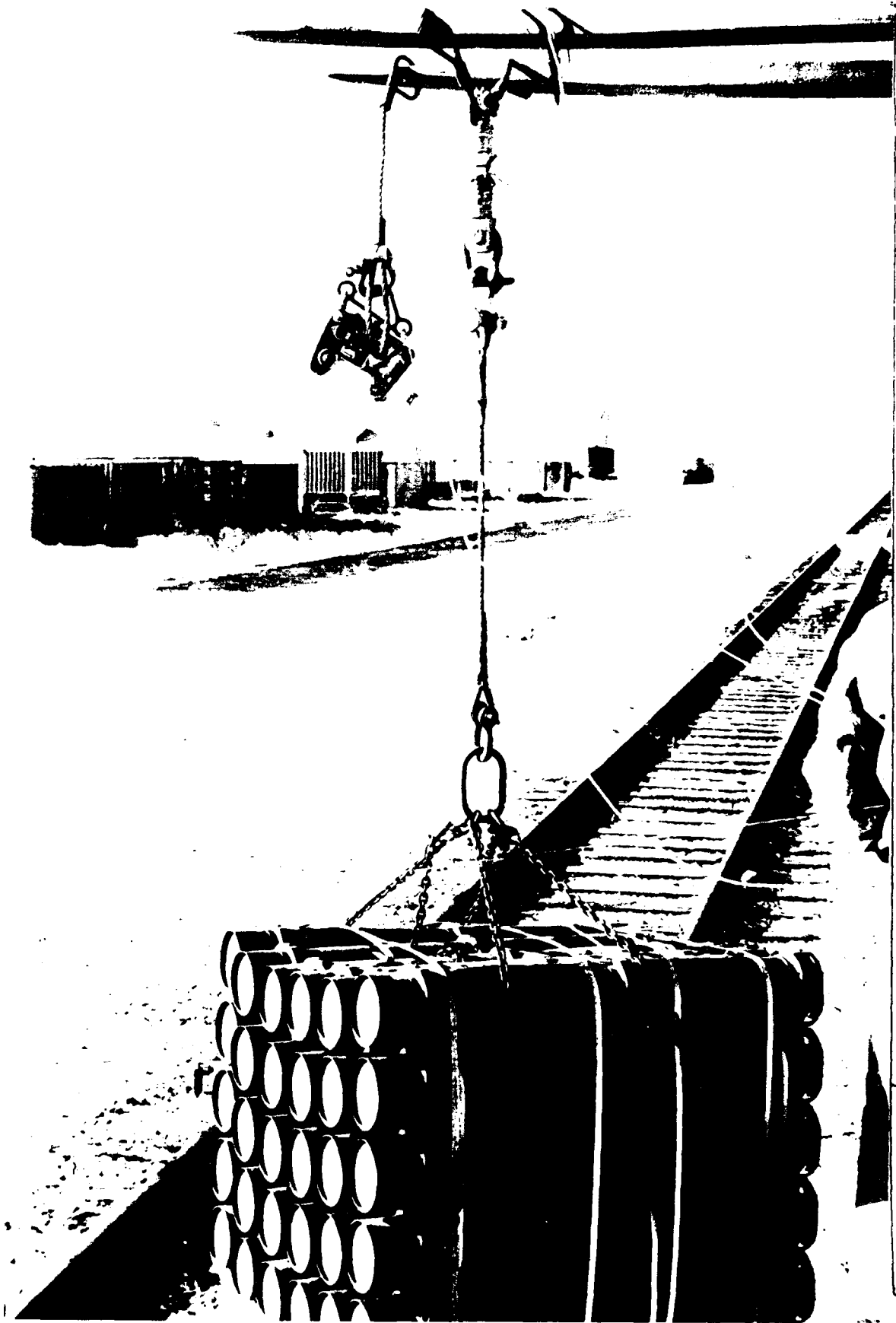
DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL

Information Center and School - Savanna, IL

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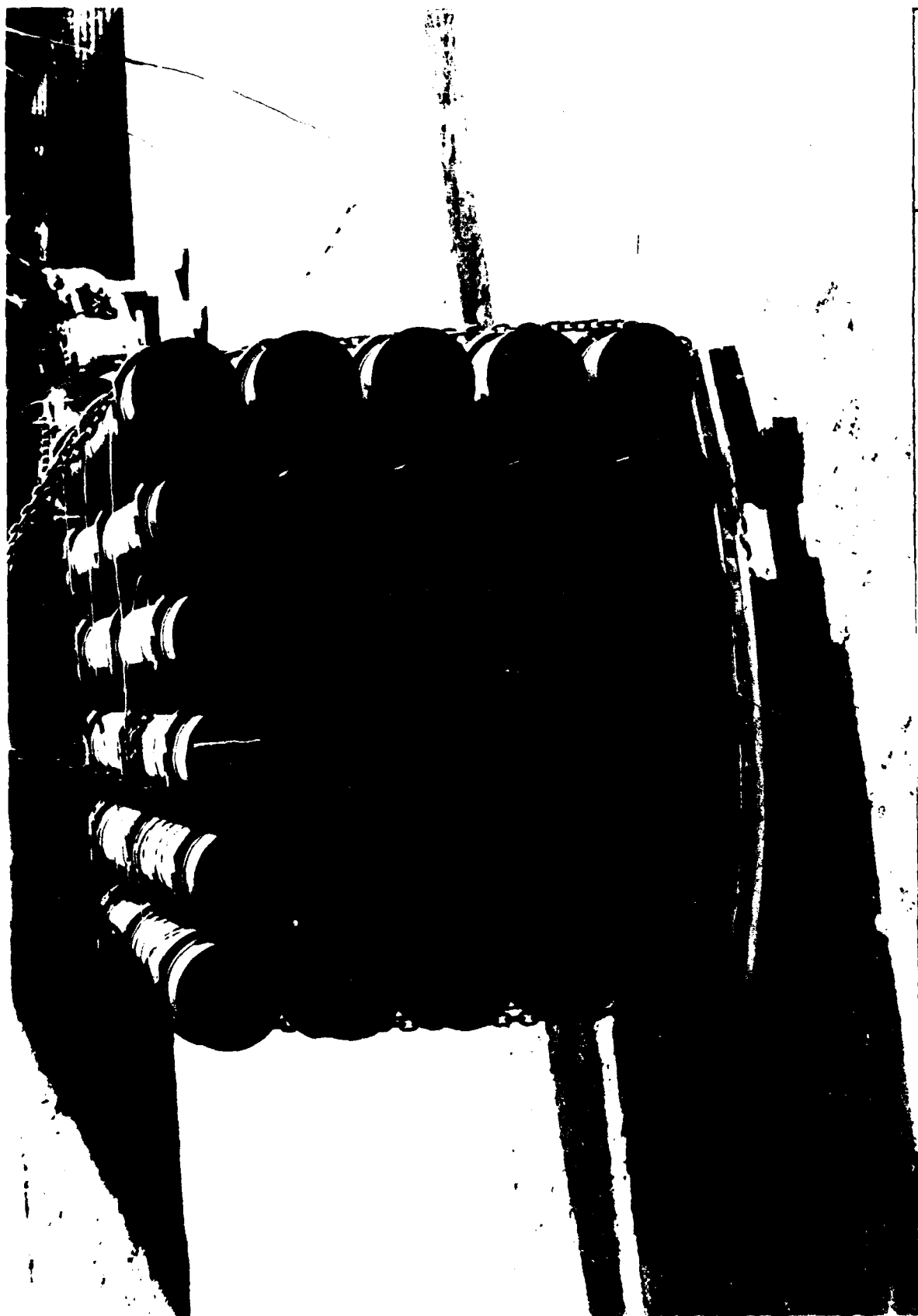
PHOTO NO 3 This photo shows the PA104 unit positioned for a drop. The chain basket sling is attached to a quick release mechanism. The apparatus to the right is a load cell to measure the force when the unit reaches its drop limit. The drop limit is controlled by adjusting the cable length between the load cell and quick release mechanism.





DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL

PHOTO NO. 4 This photo shows the unit after being released. The 17 inch diameter of the test was 36 inches. Note concave shape of the top end of the unit.



DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL

PHOTO NO. 5 This photo illustrates the concavity of the unit from rapid descent tests.



	DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL
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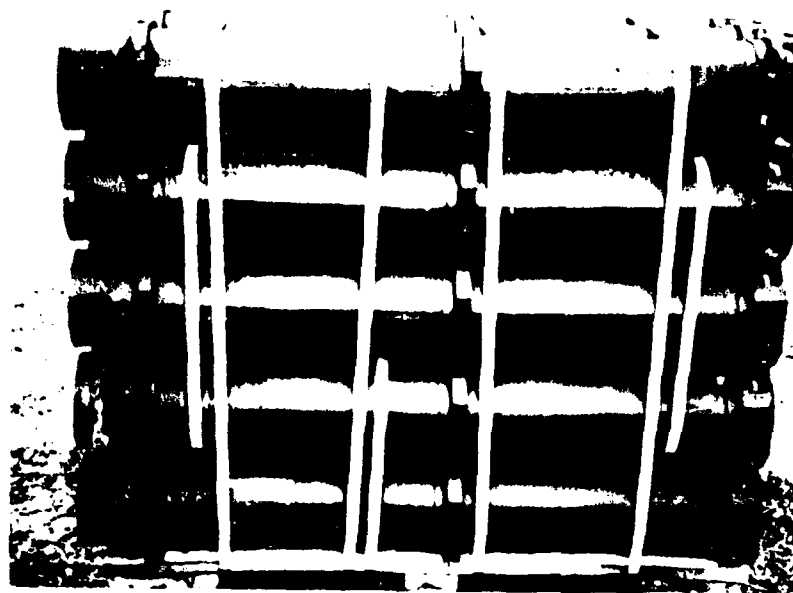
PHOTO NO. 6	This photo shows typical container damage that can be expected from rapid descent when loading or off loading with chain basket slings.
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PART 5

FIELD DATA

Data from the field indicated that using slings to handle this ammunition port resulted in numerous dented containers. One container was torn by a sling to the extent that it required unpack, patch weld, repainting and repack. The photos supplied with this field problem showed dented and torn containers. The dents were located along the base end of all outside containers on one side of the unit. No photos were submitted to indicate damage to the opposite side of the pallet. The tear occurred at the base of the container in the second layer. A closeup photo showed that the base end experienced a metal tear similar to a self opening can. Marks on the pallet wings indicated that wire rope slings were used for loading or unloading the pallet at some point along the logistics trail. The dents at the container bases also indicate the use of a wire rope sling. There are no marks on the front end of the containers to show contact with the lifting sling.

The torn container in the second row is not from normal slinging operations. The amount of energy expended to tear the the PA104 shell, as illustrated by the photo could not be produced in normal safe loading or unloading operations.



This photo shows a side view of the large container used in the slinging operations.



This photo is a close-up of the large container used in the slinging operations.

PART 6

UNITIZATION PROCEDURE

APPENDIX 6A

UNITIZATION PROCEDURES FOR COMPLETE ROUNDS PACKED IN CYLINDRICAL METAL CONTAINERS ON 4-WAY ENTRY PALLETS *

PA 104 SERIES CONTAINER

INDEX

<u>ITEM</u>	<u>PAGE (S)</u>
GENERAL NOTES-----	2
UNIT DETAIL-----	4
DUNNAGE DETAIL-----	5
FILLERS AND INSTALLATION PROCEDURES FOR OMITTED CONTAINERS-----	6,7

PALLET UNIT DATA						
ITEMS INCLUDED		HAZARD CLASSIFICATION ^①				WEIGHT (LBS)
NSN	DODIC	DOT CLASS	CG CLASS	QD CLASS	COMP GROUP	
1315-						
01-233-2078	C508	A	IV	(12)1.2	E	2,464
01-226-7419	C521	B	II-B	(08)1.2	C	2,194
01-136-9631	C524	B	II-B	(08)1.2	C	2,344

① HAZARD CLASSIFICATION DATA CONTAINED IN THE ABOVE CHART IS FOR GUIDANCE AND INFORMATIONAL PURPOSES ONLY. VERIFICATION OF THE SPECIFIED DATA SHOULD BE MADE BY CONSULTING THE MOST RECENT JOINT HAZARD CLASSIFICATION SYSTEM LISTING OR OTHER APPROVED LISTING (S).

* SEE GENERAL NOTE "1" ON PAGE 2.

NOTICE: THIS APPENDIX CANNOT STAND ALONE BUT MUST BE USED IN CONJUNCTION WITH THE BASIC UNITIZATION PROCEDURES DRAWING 19-48-4079-20PM1002.

DO NOT SCALE

REVISIONS				DRAWN/REVISED		CHECKED/APPROVED	
1	JUN 86	WRF	WRF	WRF	WRF	WRF	WRF
<div style="text-align: right;"> <i>John L. Bryant</i> APPROVED BY ORDER OF COMMANDING GENERAL, U.S. ARMY DEFENSE MANAGEMENT CENTER AND SCHOOL U.S. ARMY AMC DRAWING APRIL 1985 </div>				CLASS	DIVISION	DRAWING	FILE
				19	48	4079/ 6A	20 PM 1002

PROJECT FSA 63/6A-66

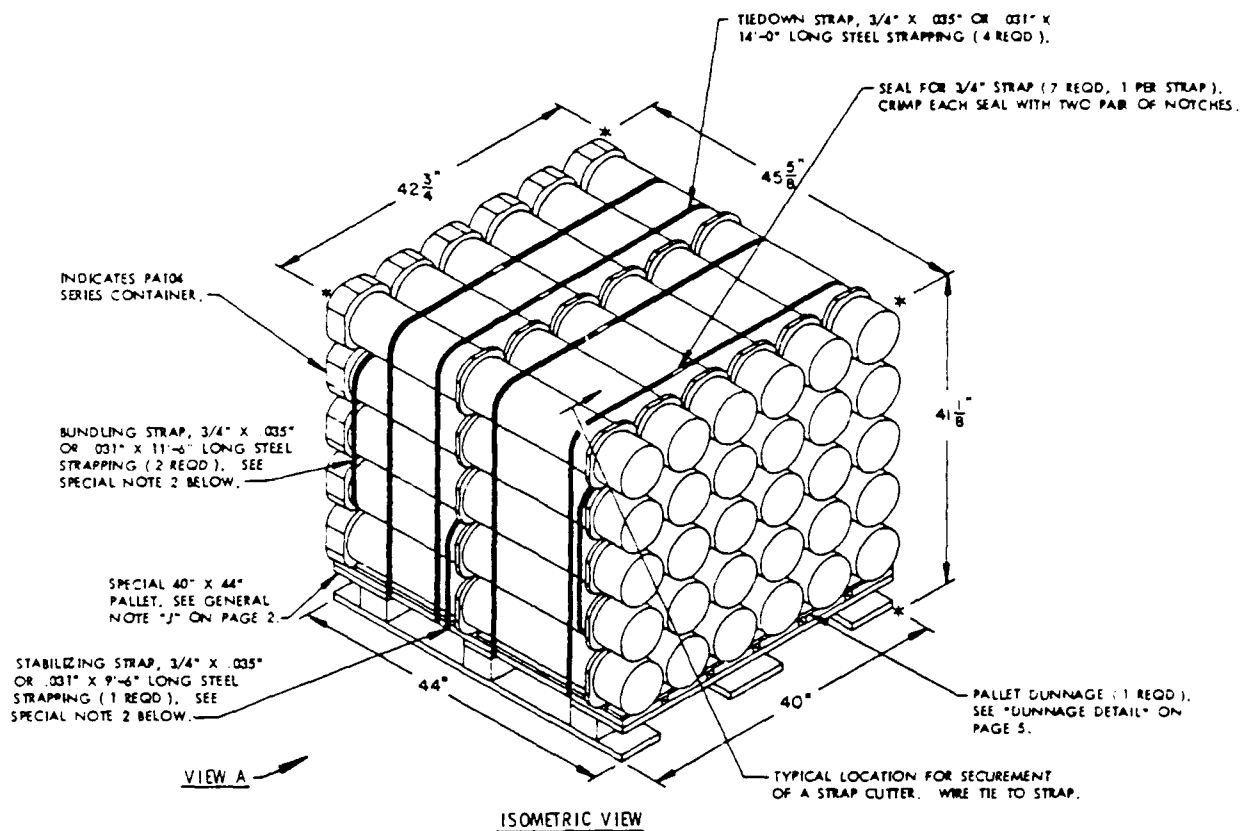
GENERAL NOTES

- A. THIS APPENDIX CANNOT STAND ALONE BUT MUST BE USED IN CONJUNCTION WITH THE BASIC UNITIZING PROCEDURES DRAWING 19-48-4079-20PM1002. TO PRODUCE AN APPROVED UNIT LOAD, ALL PERTINENT PROCEDURES, SPECIFICATIONS AND CRITERIA SET FORTH WITHIN THE BASIC DRAWING WILL APPLY TO THE PROCEDURES DELINEATED IN THIS APPENDIX. ANY EXCEPTIONS TO THE BASIC PROCEDURES ARE SPECIFIED IN THIS APPENDIX.
- B. DIMENSIONS, CUBE AND WEIGHT OF A PALLET UNIT WILL VARY SLIGHTLY DEPENDING UPON THE ACTUAL DIMENSIONS OF THE CONTAINER, WEIGHT OF THE SPECIFIED ITEM AND METHOD OF UNITIZATION.
- C. FOR OUTLOADING AND STORAGE OF THE ITEMS COVERED BY THIS APPENDIX, CONTACT THE US ARMY DEFENSE AMMUNITION CENTER AND SCHOOL, ATTN: SMCAC-DEO, SAVANNA, IL 61074-9639 FOR SPECIFIC PROCEDURAL GUIDANCE.
- D. FOR METHOD OF SECURING A STRAP CUTTER TO THE PALLET UNIT, SEE DARCOM DRAWING 19-48-4127-20P1000.
- E. IF ITEMS COVERED HEREIN ARE UNITIZED PRIOR TO ISSUANCE OF THIS APPENDIX, THE CONTAINERS NEED NOT BE REUNITIZED SOLELY TO CONFORM TO THIS APPENDIX.
- F. FOR DETAILS OF THE PA 104 SERIES CONTAINER, SEE US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND DRAWING NO. 9345267.
- CONTAINER DIMENSIONS-----45-5/8" LONG X 7-1/8" WIDE X 7-1/8" HIGH
CONTAINER CUBE-----1.3 CUBIC FEET (APPROX)
CONTAINER WEIGHT
(WITH ROUND)-----75 POUNDS (APPROX)
- G. THE UNITIZATION PROCEDURES SPECIFIED HEREIN MAY ALSO BE USED FOR UNITIZING COMPLETE ROUNDS WHEN IDENTIFIED BY DIFFERENT NATIONAL STOCK NUMBERS (NSN) THAN THOSE SHOWN ON THE COVER PAGE, PROVIDED THE ITEM IS PACKED IN THE SAME CONTAINER. THE EXPLOSIVE CLASSIFICATION OF OTHER ITEMS MAY BE DIFFERENT THAN THOSE SHOWN.
- H. DIMENSIONS GIVEN FOR DUNNAGE PIECES WILL BE FIELD CHECKED PRIOR TO THEIR ASSEMBLY TO THE PALLET UNIT. CONTAINERS MUST FIT SNUGLY IN THE DUNNAGE ASSEMBLIES.
- J. THE SPECIAL PALLET WILL BE CONSTRUCTED AND ASSEMBLED IN ACCORDANCE WITH A MILITARY SPECIFICATION MIL-P-15011, STYLE 1, TYPE I, CLASS 1 PALLET WITH THE EXCEPTION THAT THE TOP AND BOTTOM DECK BOARDS WILL BE 44" LONG INSTEAD OF 48". ALL OTHER REQUIREMENTS SPECIFIED WITHIN MIL-P-15011 FOR A STYLE 1, TYPE I, CLASS 1 PALLET WILL APPLY TO THE PALLET SPECIFIED WITHIN THIS DRAWING.

REVISION

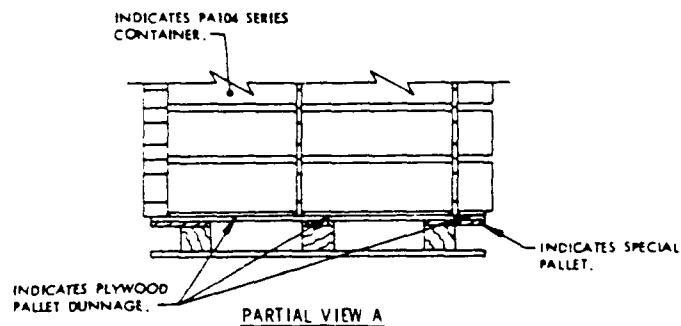
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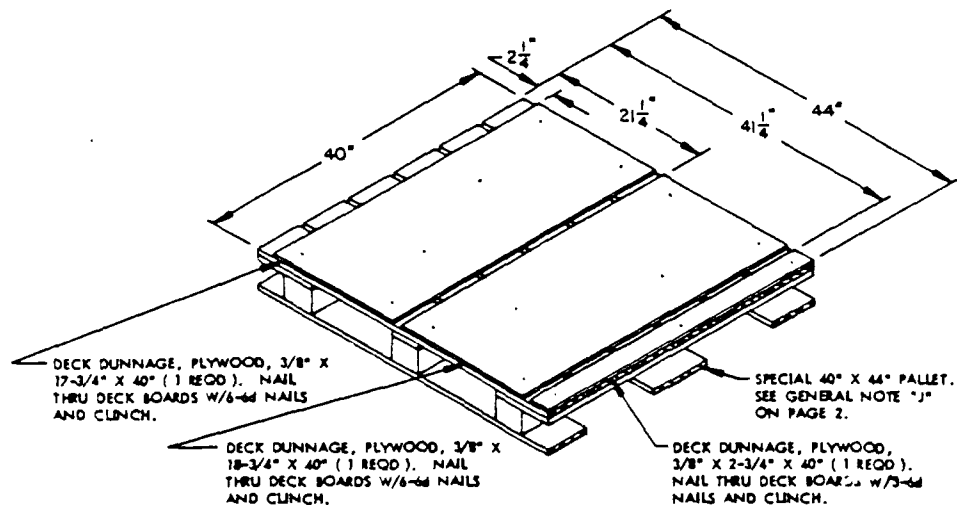
1. ADDING ITEMS BY NATIONAL STOCK NUMBERS (NSN) TO "PALLET UNIT DATA" CHART.
2. ADDING STABILIZING STRAP.



SPECIAL NOTES:

1. ALTHOUGH THE CONTAINERS DEPICTED IN THE UNIT LOAD ABOVE ARE CONSTRUCTED WITH INTERLOCKING DEVICES, THE INTERLOCKS WILL NOT FUNCTION PROPERLY UNLESS THE CONTAINERS ARE POSITIONED SO THAT THE "PINS" OF THE INTERLOCKS ARE IN AN UPRIGHT ORIENTATION. THIS ORIENTATION WILL PRECLUDE INTERFERENCE OF THE "PINS" AND THE PLYWOOD PALLET DUNNAGE AND WILL AID IN THE PREVENTION OF CONTAINER MOVEMENT, BOTH Laterally AND LONGITUDINALLY, DURING SHIPMENT OF THE UNIT LOAD.
2. BUNDLING STRAPS AND STABILIZING STRAP MUST BE TENSIONED AND SEALED PRIOR TO THE APPLICATION OF THE TIEDOWN STRAPS.
3. ALL STRAPS MUST BE INSTALLED AS CLOSE AS POSSIBLE TO THE CONTAINER RINGS. **CAUTION:** STRAPS MUST NOT BE ALLOWED TO OVERLAP.



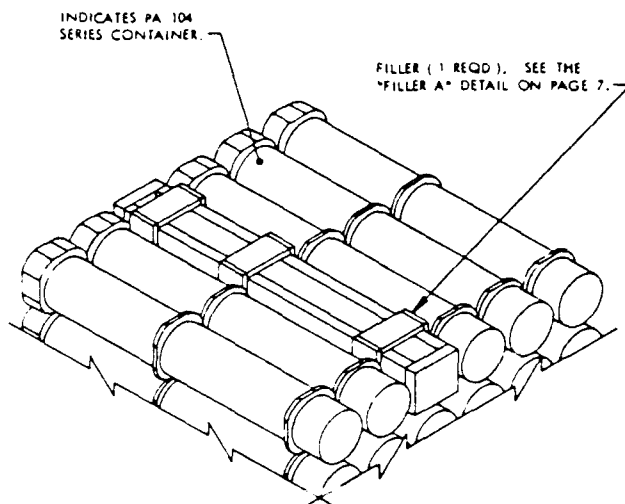


PALLET DUNNAGE LOCATION

BILL OF MATERIAL		
NAILS	NO. REQD	POUNDS
6d (2")	15	0.09
SPECIAL PALLET, 40" X 44" — 1 REQD — 77 LBS		
STEEL STRAPPING, 3/4" — 79.00' REQD — 5.64 LBS		
SEAL FOR 3/4" STRAPPING — 6 REQD — NIL		
PLYWOOD, 3/8" — 10.90 SQ FT REQD — 11.27 LBS		

UNIT DATA

CUBE	46.4 CUBIC FEET (APPROX)	
CONTAINER	30 EACH @ 75 LBS	2,370 LBS (APPROX)
DUNNAGE		17 LBS
PALLET		77 LBS
TOTAL WEIGHT		2,464 LBS (APPROX)

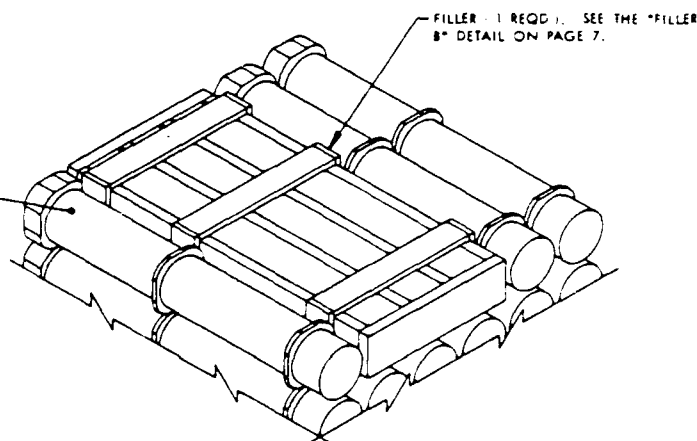


DETAIL A

THIS DETAIL DEPICTS PROCEDURES TO BE USED WHEN A STANDARD PALLET UNIT MINUS ONE CONTAINER IS TO BE UNITIZED. THE FILLER ASSEMBLY DEPICTED MUST BE INSTALLED IN THE MIDDLE OF THE TOP LAYER OF THE PALLET UNIT.

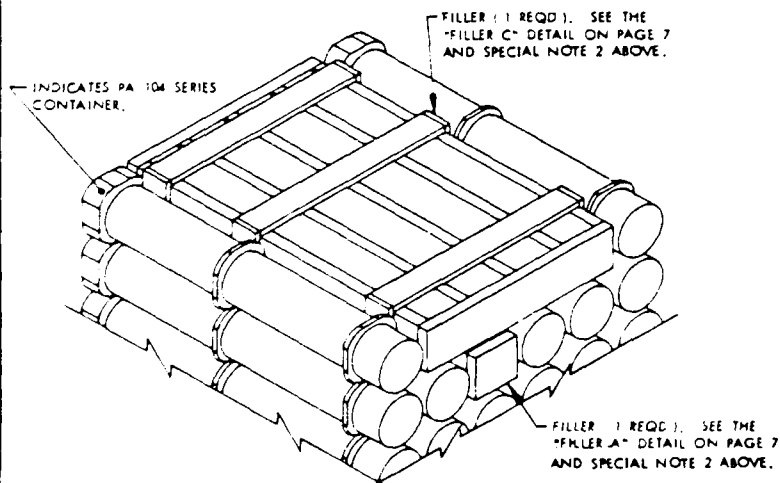
SPECIAL NOTES:

1. WHEN SIX CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, A COMPLETE LAYER OF CONTAINERS MUST BE OMITTED. WHEN FIVE CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, A COMBINATION OF FILLER ASSEMBLIES DEPICTED ON PAGE 7 MUST BE USED. WHEN FOUR OR LESS CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, A COMBINATION OR ONE OF THE FILLER ASSEMBLIES DEPICTED ON PAGE 7 MAY BE USED. ALL FILLER ASSEMBLIES MUST BE INSTALLED IN THE MIDDLE OF THE TOP LAYER OR LAYERS OF A PALLET UNIT.
2. WHEN A "FILLER A" ASSEMBLY IS USED IN COMBINATION WITH A "FILLER B" OR "FILLER C" ASSEMBLY, THE "FILLER A" ASSEMBLY MUST BE POSITIONED IN THE SECOND LAYER OF CONTAINERS FROM THE TOP OF THE PALLET UNIT AND MUST HAVE ITS OVERALL HEIGHT REDUCED FROM 7" TO 6-1/4".
3. WHEN TWO "FILLER A" ASSEMBLIES ARE USED IN PLACE OF TWO OMITTED CONTAINERS, THE FILLER ASSEMBLIES WILL BE SEPARATED BY AT LEAST ONE CONTAINER TO INSURE PROPER FILLER ASSEMBLY RETENTION AND TO PRECLUDE ASSEMBLY INTERFERENCES.



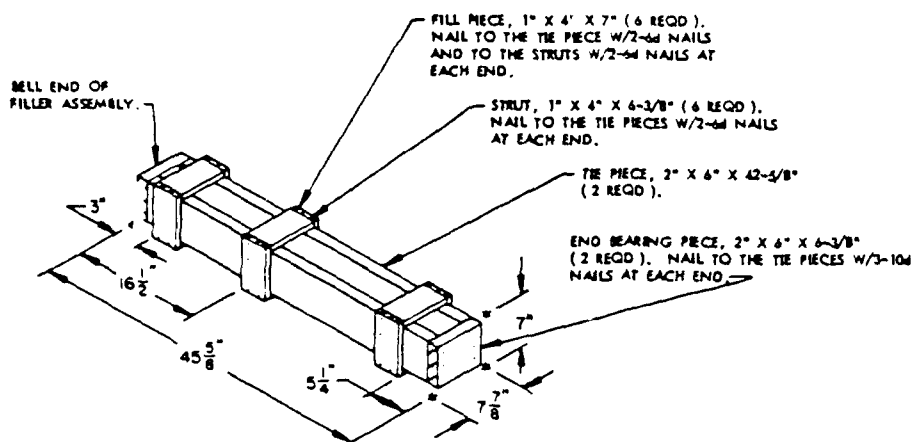
DETAIL B

THIS DETAIL DEPICTS PROCEDURES TO BE USED WHEN A STANDARD PALLET UNIT MINUS THREE CONTAINERS IS TO BE UNITIZED. THE FILLER ASSEMBLY MUST BE INSTALLED IN THE MIDDLE OF THE TOP LAYER OF THE PALLET UNIT.



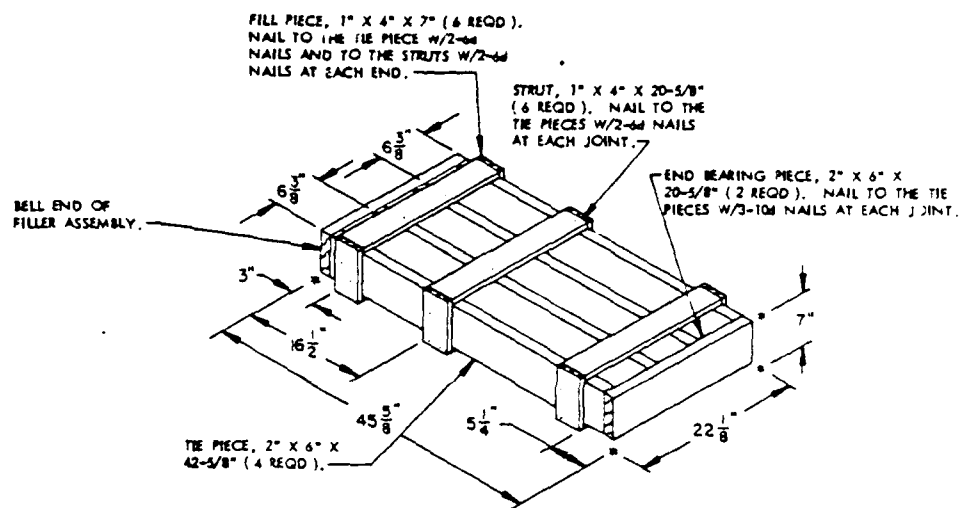
DETAIL C

THIS DETAIL DEPICTS PROCEDURES TO BE USED WHEN A STANDARD PALLET UNIT MINUS FIVE CONTAINERS IS TO BE UNITIZED. THE FILLER ASSEMBLIES DEPICTED MUST BE INSTALLED IN THE MIDDLE OF THE TOP LAYERS OF THE PALLET UNIT.



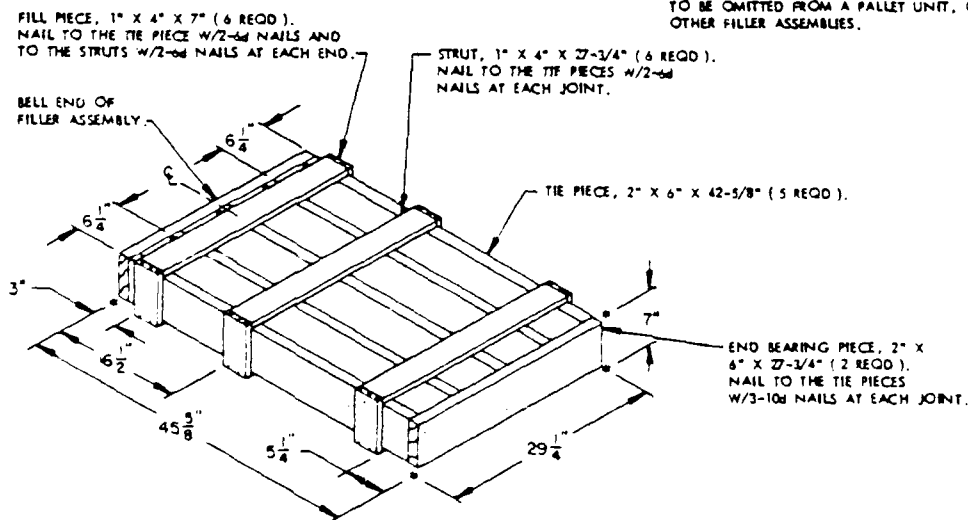
FILLER A

THIS FILLER ASSEMBLY IS TO BE USED WHEN ONE OR TWO CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, OR IN COMBINATION WITH OTHER FILLER ASSEMBLIES. SEE SPECIAL NOTES 2 AND 3 ON PAGE 6.



FILLER B

THIS FILLER ASSEMBLY IS TO BE USED WHEN THREE CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, OR IN COMBINATION WITH OTHER FILLER ASSEMBLIES.



FILLER C

THIS FILLER ASSEMBLY IS TO BE USED WHEN FOUR CONTAINERS ARE TO BE OMITTED FROM A PALLET UNIT, OR IN COMBINATION WITH A "FILLER A" ASSEMBLY.